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Mammalian Remains From Rattlesnake Cave, Kinney County, Texas

by

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—Jane Sullivan, Editor

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Mammalian Remains From Rattlesnake Cave, Kinney County, Texas

HOLMES A. SEMKEN*

Introduction

Remains of small mammals collected from a stratified bone deposit in Rattlesnake Cave, Kinney County, Texas, are interpreted to reflect control of population fluctuations by changes in moisture in the local mammalian community throughout the depositional period. These mammals indicate post-Columbian age for deposits of black fill common to many Texas caverns.

Entrance to Rattlesnake Cave, located 100 yards south of U. S. Highway 90, five miles west of Brackettville on the J. A. Bader ranch, is gained through a fifteen-foot vertical shaft which serves as a natural pitfall for small mammals. The cavern floor is littered with bone and partially decayed small animals, and excavation revealed a large sample of animal remains in underlying deposits. The collection, designated the Rattlesnake Cave local fauna, is preserved by the Bureau of Economic Geology of The University of Texas, and is catalogued under locality number 40434.

Stratigraphy and Age

Stratigraphy.—A four-foot square test pit in the center of the southeast portion of the entrance chamber of Rattlesnake Cave revealed four undisturbed conformable lithologic units in the cave fill. These units or zones are designated by number in reverse geologic order to facilitate adding possible lower units in the future.

The lowest unit, Zone 4, consists of at least fourteen inches of yellow-red fill. This sandy fill does not resemble the red fill in Longhorn and other Texas caverns (Semken, 1961), but it is distinct from the overlying black fill. Further excavation in this unit was prevented by large interbedded blocks of cavern breakdown.

The three zones above the yellow-red fill are characteristic of black fills in many other Texas caves. This conformable sequence was divided in the following manner: Zone 3—five inches thick, compact black fill associated with cavern breakdown; Zone 2—three inches thick, compact black fill with little or no breakdown; and Zone 1—one inch thick, loose black fill and surface accumulation. Since black cavern fills are identical with remnants of black soils on the Edwards Plateau today, they are considered to be black soil horizons that have been redeposited by internal drainage.

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The yellow-red fill of Zone 4 can only be dated as pre-black fill by superposition and as post-late Wisconsin on faunal evidence. The Zone 4 sample does not resemble the cool, moist late Wisconsin local faunas identified in Friesenhahn Cave (Lundelius, 1960), Miller Cave (Patton, 1963), or Longhorn Cavern (Semken, 1961). It is more closely related to the dry, prairie condition reflected by specimens collected from overlying black fill deposits of Rattlesnake Cavern, Longhorn Cavern, and with the present mammalian community.

Recent age of the black fill is confirmed by the presence of *Mus musculus*, the house mouse, in Zones 1 and 2. House mice are of Eurasian origin and there is no evidence that they reached North America before early European explorers. Thus, deposits containing house mice are at least post-Columbian in age. The presence of the house mouse also supports the idea that accumulation of black cavern fill is related to the nineteenth century period of denudation (Tharp, 1952) on the Edwards Plateau.

TABLE 1

Stratigraphic distribution of maxillae.

		Zone 4		Zone 3		Zone 2		Zone 1	
		N	%	N	%	N	%	N	%
Notiosorex	L	Jaw	....	1	....	3	....	4	....
crawfordi	R		....	1	....	16	....	3	....
Cryptotis	L	Jaw	....	3	0.9	3	0.8	4	0.9
parva	R		....	2	....	7	....	1	....
Geomys	L	Jaw	....	2	0.7	17	4.6	4	0.9
bursarius	R		....	2	0.7	7	2.0	1	0.2
Perognathus	L	61	48.0	127	....	58	16.4	173	39.8
merriami	R	54	....	129	42.0	50	....	165	....
Perognathus	L	12	....	39	....	54	15.3	71	16.4
hispidus	R	20	15.7	50	16.3	50	....	66	....
Reithrodontomys	L	0	....	9	....	7	....	5	1.2
sp.	R	2	1.6	14	4.6	11	3.1	1	....
Peromyscus	L	7	....	12	....	25	....	16	3.7
sp.	R	13	10.3	12	3.9	31	8.7	12	....
Baiomys	L	3	....	19	....	35	9.8	27	....
taylori	R	5	3.9	20	6.5	30	....	30	6.9
Onychomys	L	4	3.1	26	8.5	27	7.6	17	3.9
leucogaster	R	3	....	21	....	26	....	13	....
Neotoma	L	2	1.6	2	....	5	....	9	....
micropus	R	1	....	6	1.9	6	1.7	10	2.3
Sigmodon	L	12	....	30	....	75	....	91	....
hispidus	R	13	10.3	35	11.4	103	29.0	96	22.1
Mus	L	No		No		2	0.6	5	1.2
musculus	R	Record		Record		0	....	4	....
Unidentified	L	7	....	5	....	1	....	0	....
	R	7	5.5	8	2.6	1	0.3	2	0.5
Total		127	100.0	307	100.0	355	100.0	434	100.0

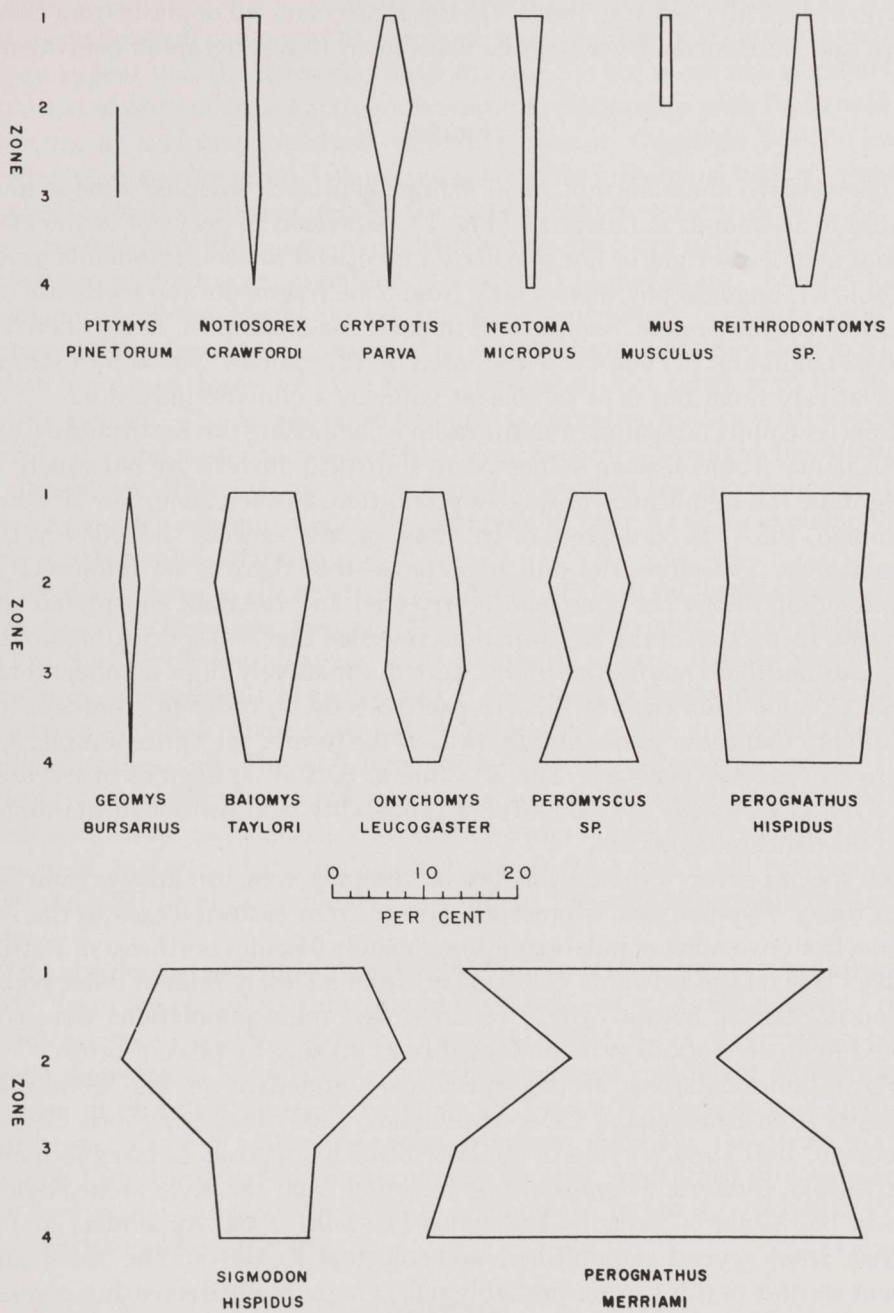

Fig. 1—Abundance diagram of small mammals from Rattlesnake Cave, expressed in per cent of the maximum number of individuals identified per zone. Samples from Zones 1, 2, and 3 were collected from deposits of black fill. The Zone 4 sample was collected from underlying yellow-red fill. Intervals between zones do not represent relative time or fill thickness.

All species identified in Rattlesnake Cave were also recorded in Longhorn Cavern black fill (Semken, 1961). On this basis, black fill deposits from Longhorn and Rattlesnake Caves can be considered biostratigraphic equivalents.

Fauna

The relative abundance of small mammals in each sampled zone is illustrated in an abundance diagram (Fig. 1), expressed in per cent of the maximum number of right or left maxillaries identified in each taxonomic group (Table 1). Lagomorphs, known only from bone fragments and teeth, are not included in the sample. Sample size in each zone, except 4, is between 307 and 434 individuals. Zone 4 is represented by 127 animals. The Zone 4 sample is relatively small but is of significant value as a climatic indicator.

Species counts tabulated from the sample comprising the Rattlesnake Cave local fauna, Table 1, were subjected to statistical analysis by *chi-square* to determine the significance of species proportions in each zone. The X^2 value obtained, 163.37 at 36 degrees of freedom, greatly exceeds the .005 level of significance. Therefore, the null hypothesis—that there is no difference in species proportions per zone, can be rejected and the data considered significant. Inspection of the X^2 tabulations revealed that two species, *Sigmodon hispidus* and *Perognathus merriami*, added a relatively high number to the total X^2 value from each of their respective cells. In order to eliminate the possibility that these values unduly swayed the results, the entire sample, less these species, was analyzed. The X^2 value of 62.2 at 30 degrees of freedom received also exceeds the .005 level of probability, and further substantiates that the data are significant.

All species except *Pitymys pinetorum*, the pine vole, are known from the area today. *P. pinetorum* is presently known from eastern Texas to the Atlantic, from two relict populations approximately 95 miles northeast of Rattlesnake Cave on the Edwards Plateau, and from a closely related relict population in Mexico. Bryant (1941) reported that relict populations were collected in an area of tall grass protected from grazing by piles of brush.

Fossil representatives of this species are abundant in late Wisconsin deposits from Friesenhahn Cave (Lundelius, 1960) and Longhorn Cavern (Semken, 1961) and are rare in the later black fill deposits in Longhorn and Rattlesnake Caverns. *Pitymys* also is recorded from the Kyle archeological site in Hill County, Texas by Lundelius (In Jelks, 1962, Appendix) and is known from several unpublished archeological localities. The fossil and recent records of this species probably reflect a gradually decreasing population on the Edwards Plateau from a widespread late Wisconsin distribution. This subfossorial form probably suffered from top soil loss as well as from increasing temperature and aridity in the past century.

Assuming a random sample, the abundance diagrams suggest that the mammals, with the exception of *Neotoma, Reithrodontomys* and *Onychomys,*

had most similar proportions in Zones 1 and 3 with a relatively marked change in Zone 2. Animals that require more moisture are more abundant in Zone 2 at the expense of those that prefer more xeric conditions. At first inspection it may appear that the marked change in Zone 2 is the result of a population explosion of *Sigmodon,* reflecting a reciprocal relationship with *Perognathus merriami* in a closed statistical system. However, *Cryptotis parva* (least shrew), *Geomys bursarius* (plains pocket gopher), *Baiomys taylori* (pigmy mouse), as well as *Sigmodon hispidus* (cotton rat) increase in Zone 2. All of these species have the major part of their range in more mesic regions. The desert shrew (*Notiosorex crawfordi*), Merriam's pocket mouse (*Perognathus merriami*) and the hispid pocket mouse (*Perognathus hispidus*) show a corresponding decrease in Zone 2. The desert shrew and Merriam's pocket mouse are desert forms and the major portion of their range is to the west of this locality. The hispid pocket mouse is a prairie species with a range equally divided east and west of the cave. Accordingly, slight fluctuations in climatic conditions would not be expected to affect the abundance of this species as much as some others. Its reduction in Zone 2 can be explained by increased moisture conditions.

The significance of the relative abundance of these indicator species was evaluated by *chi-square* analysis. Mesic species—*Cryptotis parva, Baiomys taylori,* and *Sigmodon hispidus*—were compared to xeric species *Notiosorex crawfordi, Perognathus hispidus,* and *P. merriami* between each zone on a collective and individual basis where more than eight units could be assembled into a cell. The null hypothesis, that the differences are *not* significant, was rejected for each successive zone to at least the .025 level of confidence in all calculations with one exception. The difference in abundance of *B. taylori* and *P. hispidus* between Zones 3 and 4 fell between the .500 and .250 level of confidence upholding the null hypothesis for these data.

The northern grasshopper mouse, *Onychomys leucogaster,* is a prairie and desert form which ranges primarily to the north and west of the locality but avoids extremely rocky situations (Egoscue, 1960). Thus, there was a continued decrease in abundance of grasshopper mice coincident with topsoil removal during deposition of the black fill. Presently, the area surrounding Rattlesnake Cave is extremely rocky. *Neotoma micropus* (southern plains woodrat), on the other hand, is common in arid, short grass environments and overgrazed range (Ivey, 1957). An increase in number would be expected with increasing aridity.

Summary

Mammalian remains recovered from successive lithic units within Rattlesnake Cave, Kinney County, Texas indicate small but significant fluctuations in the south-central Texas mammalian community during the depositional period of the Rattlesnake Cave local fauna.

Identified species suggest that prairie conditions prevailed throughout the period of accumulation of the local fauna. A decrease in the relative abundance of the xeric indicator species, *Notiosorex crawfordi*, *Perognathus hispidus*, and *P. merriami* with a corresponding increase in the more mesic species, *Cryptotis parva*, *Baiomys taylori*, and *Sigmodon hispidus* in the stratigraphic sequence indicates that the relatively dry prairie situation in existence today was interrupted at least once by a period of increased moisture.

Questions concerning the age and origin of black fills characteristic of many caverns on the Edwards Plateau are partially answered by the Rattlesnake Cave local fauna. The presence of *Mus musculus*, a post-Columbian Eurasian import, and the gradual decrease in abundance of *Onychomys leucogaster*, a species that prefers loamy soil, through the black fill segment of the stratigraphic sequence relates black fill deposits to progressive soil loss via internal drainage late in geologic time. The Rattlesnake Cave local fauna thus supports the contention that the Edwards Plateau was once covered with a mature top soil.

Fragmentary remains of *Pitymys pinetorum*, the only species that does not live in the area today, further substantiates the idea that *Pitymys* was widespread on the Edwards Plateau until very recent time.

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